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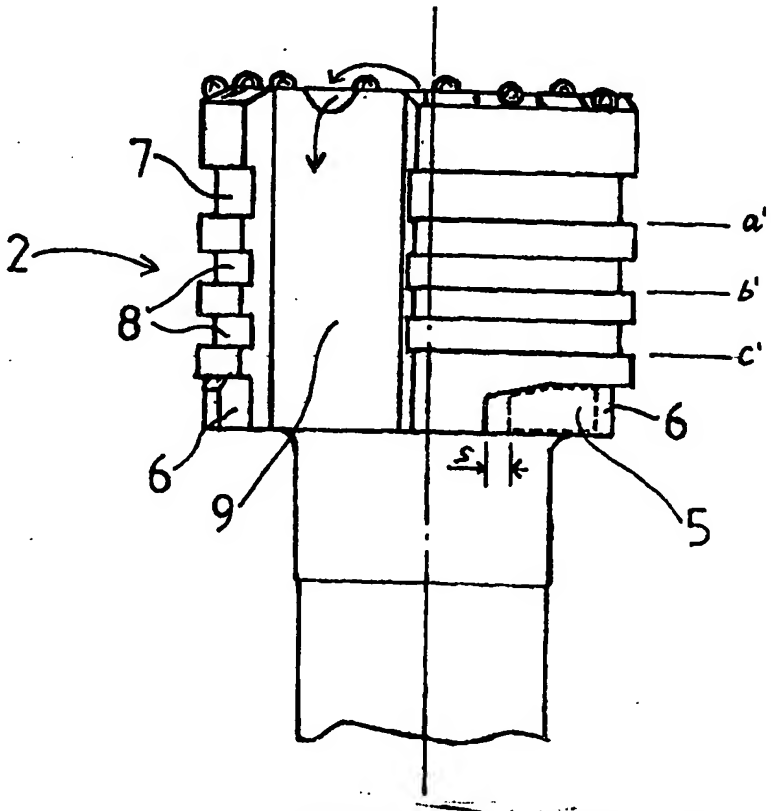
(54) Title: BIT ASSEMBLY

(57) Abstract

A bit assembly for drilling a hole into soil or rock comprised of an inner bit (2) rotated by a drilling aggregate, and of a ring bit (1) which can be locked in and detached from the inner bit, whereby the locking between the bits can be opened and the inner bit pulled out from the hole while the ring bit remains in the hole and where there is between the bits a face (e, e') transmitting axial force in the drilling direction from the inner bit to the ring bit. The system, for instance hollow (11) or corresponding elevation (5), has a slanting counter-surface (10) in order to eliminate backlash in drilling situations and to produce uninterrupted tightening for the axial-force-transmitting faces of said bits, and that the counter-faces of said elements, either of the hollow or the elevation, prevent partly or completely ring bit and/or protection tube (12) from moving farther than the inner bit.



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BIT ASSEMBLY

This method relates to a drill bit assembly, where a hole is drilled with several drill bits detachable from one another and where, by means of a component transmitting the turning motion, the bit that drills the inner hole portion rotates the ring bit that drills the outer hole portion.

Previously is known from the Finnish publication no. 9330774 a component transmitting the turning motion from the inner bit to the ring bit which is a four-cornered elevation on the ring bit inner surface. The inner bit has a corresponding, slightly loose groove whose one end is closed and which matches the elevation that hits the groove end. The turning motion is transmitted from the gable-end to the elevation and to the ring bit.

In such a solution the strokes used by percussion drilling are transmitted from the inner bit to the ring bit over a separate ring-shaped counter-face. It is difficult to get sufficient surface area for the ring-shaped counter-face and often it is damaged much too soon. It has been established that the major reason for damage is backlash existing between the bits and keeping the ring-shaped counter-face shoulder open at the moment of stroke. It is obvius that when there is backlash between the bits already from the beginning, there is even at the moment of stroke backlash between the counter-faces. The backlash leads to rapid tear and weat of the counter-faces and poor transmit of impact energy into rock.

In order to solve the existing problem a simple improvment has unexpectedly been found that eliminates the backlash in all situations and does not cause any require any additional accuracy in the mutual fit of the bits by bit production. The invention is characterized in what is presented in the patent claims.

Among the most important advantages of the invention is that in utilizing the turning motion of bits at least the backlash can be eliminated in drilling situations. The bits get tightened mutually against their stroke-transmitting counter faces and retain that state all the time during driling. The arrangement locks the mutual rotation of the bits, transmits partly also itself strokes to the ring bit, the arrangement also prevents the ring bit from falling off the inner bit on starting drilling and prevents also in drilling situations the ring bit and/or the protecting tube from moving farther than the inner bit. The wear of the component in the arrangement can be easily noticed and the wear does not have any effect on the functions. The counter faces last longer and the strokes are effectively transmitted even from the ring bit into rock.

If there are in the bit assembly several bits within and detachable from each other, the sequence of their opening can be made to follow as wanted in arranging the coupling that is to be opened at first more easily opened with respect to its oblique angle on rotating the bit in its opening direction.

In the following the invention is disclosed with reference to the enclosed drawing, where

Fig. 1 shows a ring bit.
Fig. 2 shows an inner bit used in combination with the ring bit.
Fig. 3 shows another inner bit and ring bit combination.
Fig. 4 shows a third inner bit and ring bit combination.

Figure 1 shows extensions 3 and 4 in three rows on the inner ring bit surface and similarly placed on the inner circumference. Most suitably the extensions are arranged with equal spacings on three spots. In the lower part of the ring bit there are special elevations 5, three of them, too, placed at the extensions. The upper surface of elevations 5 has a level portion and a slanting portion 10.

Figure 2 shows a corresponding inner bit with grooves 7 and 8 for ring bit extensions 3 and 4. There are grooves also with equal spacings in three spots on the inner bit outer surface. Further, there are in the bit three axial grooves 9 along which the ring bit extensions can shift over by ring bit assembly onto the inner bit. With the ring bit in proper place, the ring bit is turned so that extensions 3 and 4 enter the corresponding grooves 7 and 8. Also the lower edg elevation 5 enters the matching hollow 6. When turnig is carried out to its end, the ring bit is tightened with respect to the inner bit by the slanting surface of elevation 5 so that the backlash between the extensions is eliminated.

In this solution the function of the grooves and extensions is transmission of strokes from the inner bit to the ring bit. The rotation of inner bit 2 prevents backlash between the bits. Elevation 5 or groove 6 may be wearing, since as wear-out allowance a distance s has been arranged before the elevation hits the wall of the groove, whereby elimination of bakclash stops.

In figures 1 and 2 the position of the counter faces is marked with references a,a′ b,b′ and c,c′. Surface a, for instance, is tigthened against surface a′, likwise surface b against surface b′ a.s.o.

Figure 3 shows another embodiment, where elevation 5 is on the inner surface of ring bit 1′. By means of elevation 5 the counter faces d,d′ are tightened so as to be free of backlash. The upper surface of elevation 5 is divided into a level portion 13 and a slanting portion 10. The oblique angle is α and its value most suitably between 4° - 30°. A big angle reduces the tightening effect and facilititates also the falling of ring bit off its locking when the inner ring is not being rotated. The most advantageous oblique angles are between 5° - 10°. Drill waste is conveyed through the inner bit along the channel marked with broken lines.

In figure 4 there is still one version, where the counter-faces are marked with references e,e'. The drill waste is conveyed along the same channel 9 as where the axial motion is carried out by elevation 5 in the detaching and fitting stage of the bits. Level portion 13 of the elevation secures the ring bit in place on the inner bit when the bit assembly is upright on starting drilling, for instance. The elevation 5 itself, by its axial locking effect, prevents the ring bit and then also the protecting tube 12 from moving moving farther than inner but if drilling is done downward into soft ground. The inner bit turning motion in proper direction secures the function of elevation 5 as well as the functions of locking and elimination of backlash.

By mutual production of bits 1 and 2 it must be observed that the stroke transmitting counter-face is dimensioned with respect to the position both of elevation 5 and the hollows so that the counter-faces come into contact within the area where the slanting surface 10 reaches its counter-face in the locking arrangement. In addition, there still must be some wear-out allowance s over (figure 2).

The elevation can be either in the ring bit or in the inner bit and, correspondingly, the hollows 6,9,11 in the ring bit or in the inner bit. There can be between the bits several counter-faces (figures 1,2) and several locking arrangements, i.e. elevations in succession, as shown in figures 1 - 4. There can be elevations 5 and, correspondingly, hollows, also side by side as well as in succession. There must not necessarily be a slanting portion 10 in both counter-faces, but the version in figure 2 works, for instance, if there is in hollow 6 a slanting portion, as shown, whereby elevation 5 can be ring-shaped or four-cornered with rounded corners. As to wearing, slanting surfaces are more advantageous.

If the bit assembly includes several bits, like an inner pilot bit, around it the first ring bit and then around it a second

ring bit and between bits a slanting-surface-locking 10 according to the invention, the bit opening arrangement can be adjusted by means of slanting surface 10 and angle α. At first the coupling opens in which a greater angle α is used and the last to open is the coupling with a smaller angle. The coupling with the smaller angle gets more effectively tightened and, accordingly, it is the last to open.

PATENT CLAIMS

1. A bit assembly for drilling a hole into soil or rock comprised of an inner bit (2) rotated by a drilling aggregate, and of one or several ring bits (1) which can be locked in and detached from the inner bit and is rotated by inner bit (2) by means of a mutual locking arrangement in the face of joint of the said bits, and possibly of a protecting tube (12) which can be pulled into the hole by bit (1) or ring bit (2), in which assembly the locking between bits (1) and (2) can be opened and the inner bit (2) pulled out from the hole while the ring bit remains in the hole or it is possible to continue drilling with inner bit (2) through ring bit (1) and where there is between the bits one or several faces (a,a' - e,e') transmitting axial force from the inner bit to the ring bit in the drilling direction, characterized in that the system, for in-stance hollow (6),(9),(11) or corresponding elevation (5), transmitting torsion from inner bit (2) to ring bit (1), has a slanting counter-surface (10) or both counter-surfaces are slanting in order to eliminate backlash in drilling situations and to produce uninterrupted tightening for the axial-force-transmitting faces (a,a' - e,e') of said bits, and that the counter-faces (10),(13) of said elements, either of hollow (6),(9),(11) or elevation (5), prevent ring bit (1) and/or protection tube (12) from moving farther than inner bit (2).

2. A bit assembly according to patent claim 1 characterized in that the angle α of slanting of surface (10) is between 4°-30°.

3. A bit assembly according to patent claim 1 and 2, characterized in that on detaching the bits from one another or assembling them the axial motion of elevation (5) including slanting surface (10) in the face of joint between the bits is arranged to take place in groove (9) along which the drill waste is transported.

4. A bit assembly according to any of the above patent claims, characterized in that the counter-faces (10) or their horizontal extensions (13) between the bits prevent the ring bit and/or the protection tube from falling off when the bit assembly is upright.

5. A bit assembly according to any of the above patent claims, characterized in that between elevation (5) and matching groove (6),(9),(11) as wearing allowance for the surfaces a distance (s) is arranged.

6. A bit assembly according to any of the above patent claims, characterized in that elevation (5) and hollow (6), are in the lower part of the face of joint between the bits, whereat the hollow is devoid of a lower wall.

7. A bit assembly according to any of the above patent claims, 1 - 6 characterized in that when there are several ring bits the components (5) used for locking them have differing oblique angles (α) of surface (10) in order to produce a wanted sequence of opening the ring bits.

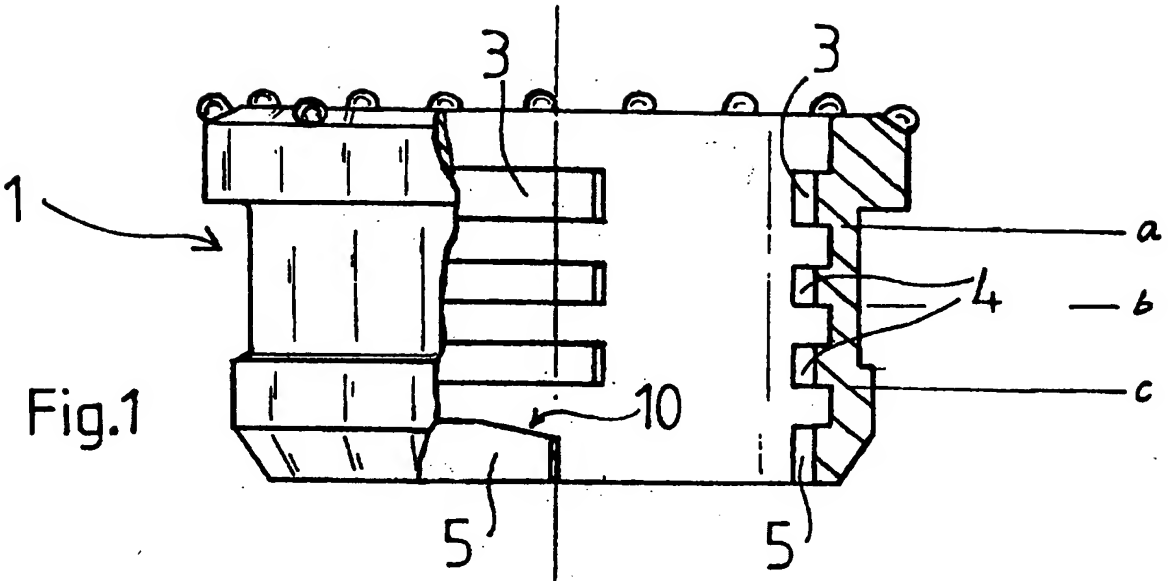

Fig.1

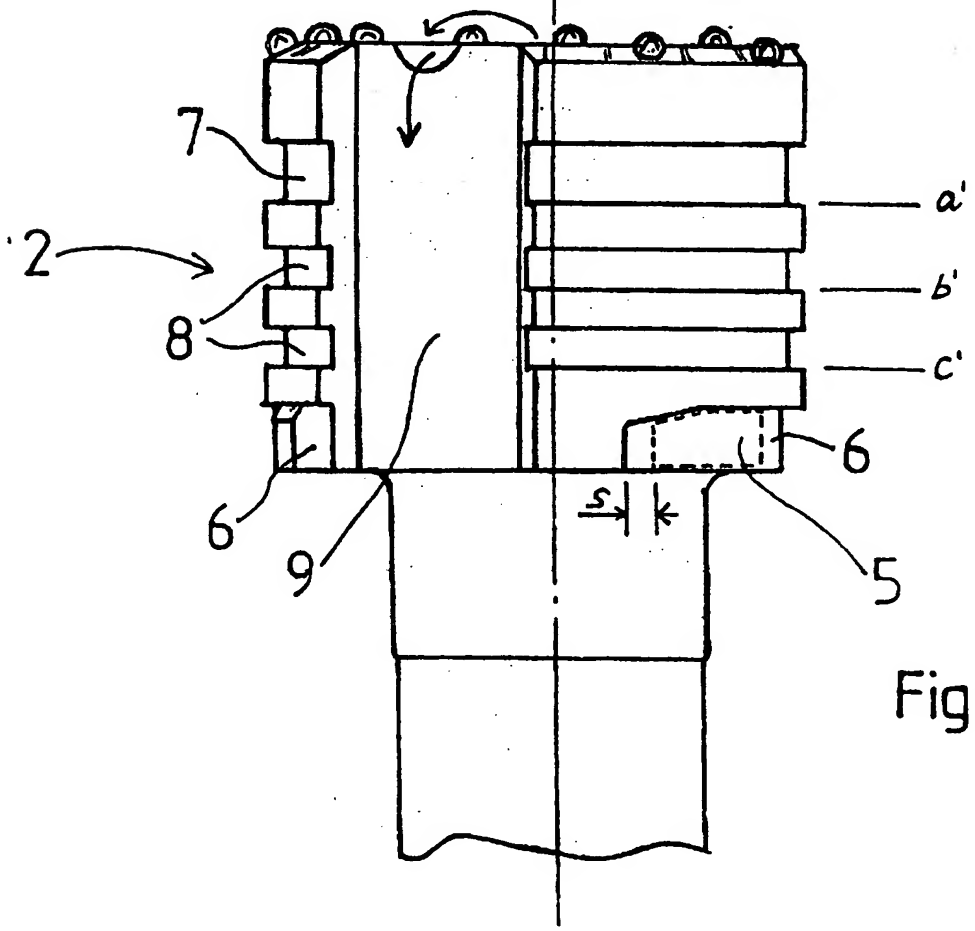

Fig.2

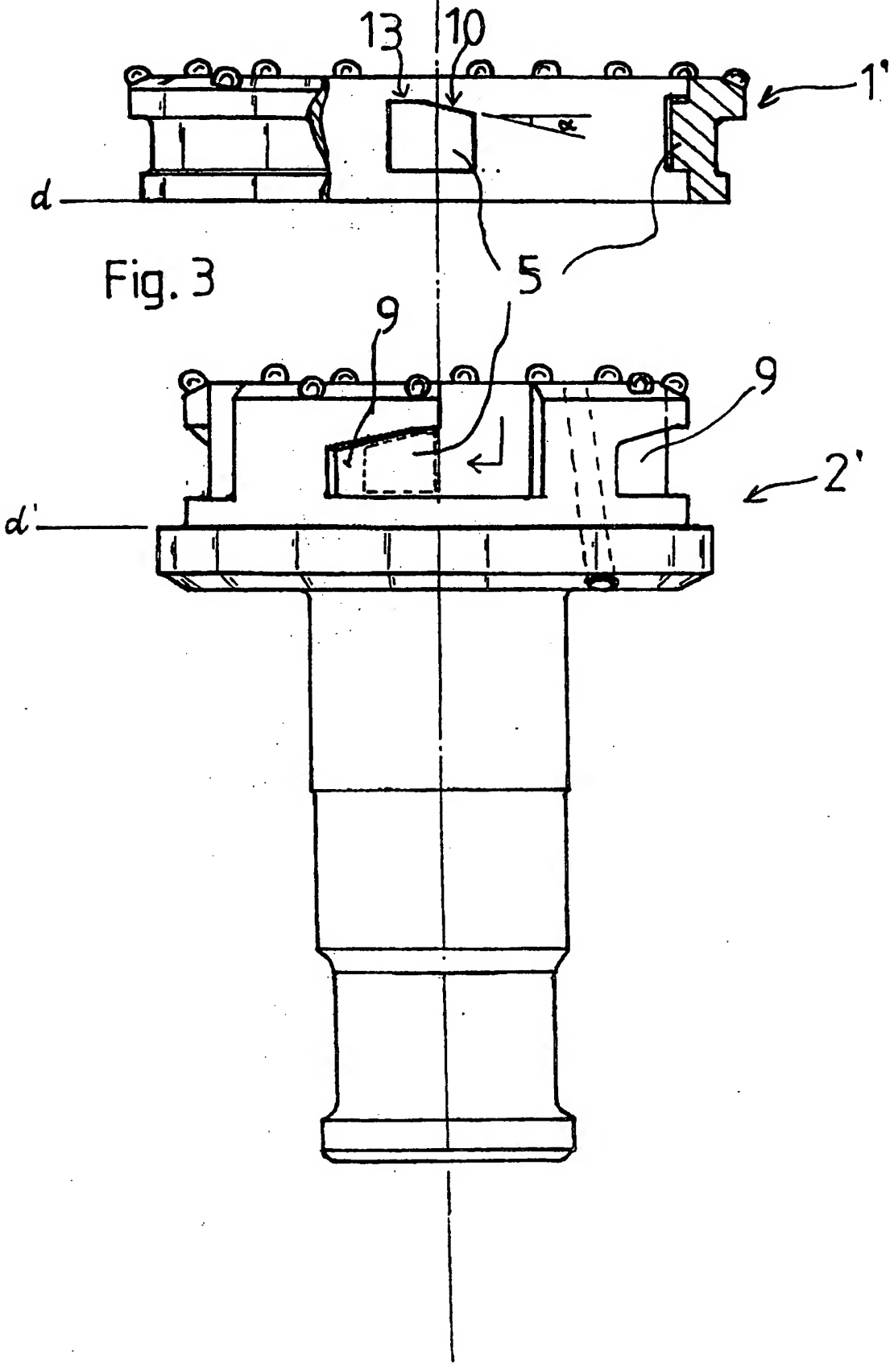

Fig. 3

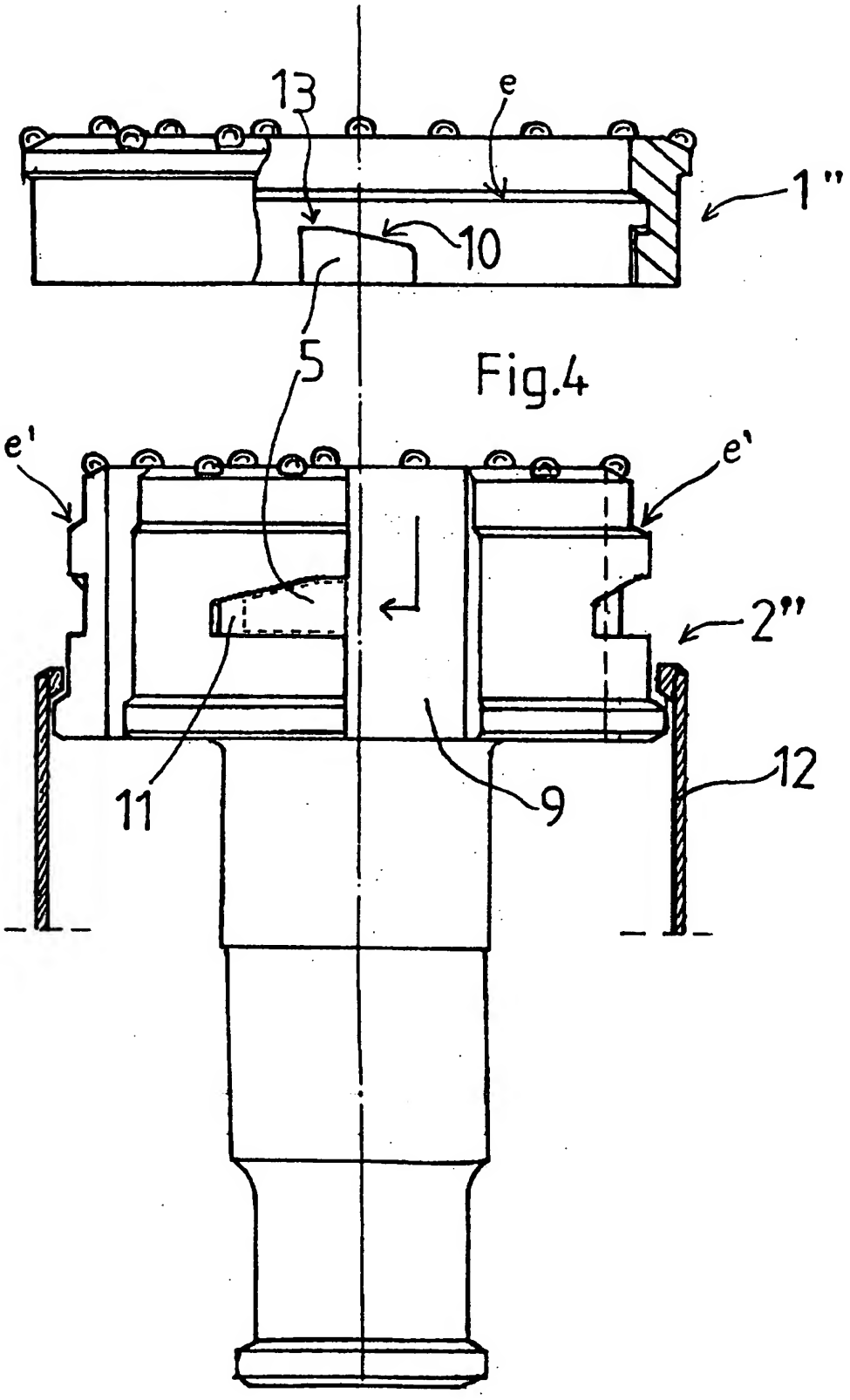

Fig.4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 97/00578

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: E21B 17/046, E21B 10/62
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: E21B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5590726 A (J. JARVELA ET AL), 7 January 1997 (07.01.97) --	1-7
A,P	WO 9618798 A1 (ILOMÄKI, V.), 20 June 1996 (20.06.96) --	1-7

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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INTERNATIONAL SEARCH REPORT

Information on patent family members

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5590726 A	07/01/97	AT 159561 T	15/11/97
		AU 677620 B	01/05/97
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